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UK Patent Application GB 2 284 427 A

(43) Date of A Publication 07.06.1995

(21) Application No 9424384.7

(22) Date of Filing 02.12.1994

(30) Priority Data

(31) 4341495

(32) 06.12.1993

(33) DE

(51) INT CL⁶
C09B 19/02

(52) UK CL (Edition N)
C4P PBA PBA6C4 P104

(56) Documents Cited
US 4395545 A

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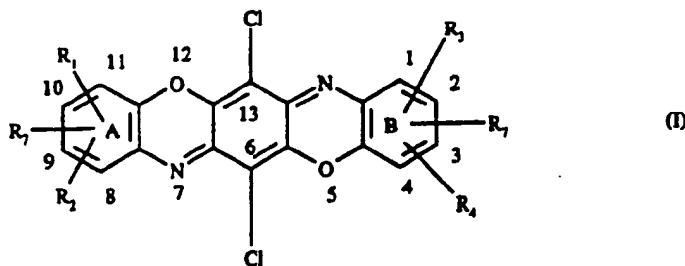
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(58) Field of Search
UK CL (Edition N) C4P PBA
INT CL⁶ C09B 19/02
ONLINE DATABASES: CAS

(54) Triphendioxazine compounds

(57) Triphendioxazine compounds of formula I are provided,



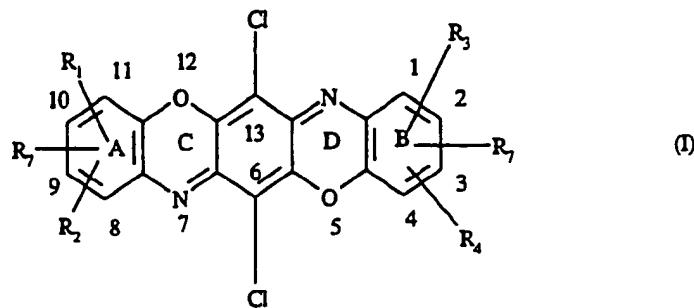
in which R₁ and R₂ are either both hydrogen or form a single chain linking the 8,9-; 9,10- or 10, 11-positions, the single chain having the formula -NR₅-(CO)_m-NH-, -CR₅=CH-CO-NH-, -O-CH₂-CO-NH-, -CO-CH=CR₅-NH-, -CO-NH-CO-NH-, -CO-NH-CR₆=N-, -CR₆=N-CO-NH-, -NR₆-(CO)_m-O- or -NH-CR₅=N- where R₅ is hydrogen, C₁₋₄alkyl or phenyl, R₆ is hydrogen, C₁₋₄alkyl or phenyl; m is 1 or 2 and R₃ and R₄ are either both hydrogen or form a single chain linking the 1,2-, 2,3- or 3,4-positions, the single chain having a formula selected from NR₅-(CO)_m-NH-, -CR₅=CH-CO-NH-, -O-CH₂-CO-NH-, -CO-CH=CR₅-NH-, -CO-NH-CO-NH-, -CONH-CR₆=N-, -CR₆=N-CO-NH-, -NR₆-(CO)_m-O- or -NH-CR₅=N- where the symbols R₅, R₆ and m are defined above and when R₃ and R₄ are in the 1,2- position and R₇ is located in the 3- position or when R₃ and R₄ are in the 3,4- position and R₇ is located in the 2-position or when R₁ and R₂ are in the 8,9- position and R₇ is located in the 10-position or when R₁ and R₂ are in the 10, 11- position and R₇ is in the 9- position then R₇ is hydrogen or C₁₋₂alkoxy, otherwise R₇ is hydrogen, with the proviso that if R₁ and R₂ are hydrogen then R₃ and R₄ cannot be hydrogen. These compounds are useful as pigments.

GB 2 284 427 A

Triphendioxazine compounds

The invention relates to new triphendioxazine compounds for use as pigments particularly in mass pigmenting of plastics material.

According to the invention, there is provided a compound of formula I,



in which R_1 and R_2 are either both hydrogen or R_1 and R_2 together form a chain linking the 8,9-; 9,10- or 10, 11-position, the single chain having a formula selected from $-NR_5-(CO)_m-NH-$, $-CR_5=CH-CO-NH-$, $-O-CH_2-CO-NH-$, $-CO-CH=CR_5-NH-$, $-CO-NH-CO-NH-$, $-CO-NH-CR_6=N-$, $-CR_6=N-CO-NH-$, $-NR_5-(CO)_m-O-$ or $-NH-CR_5=N-$

where

R_5 is hydrogen, C_{1-4} alkyl or phenyl,

R_6 is hydrogen, C_{1-4} alkyl or phenyl

m is 1 or 2 and

R_3 and R_4 are either both hydrogen or

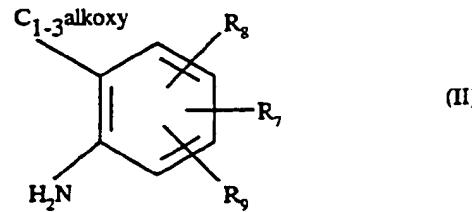
R_3 and R_4 together form a chain linking the 1,2-, 2,3- or 3,4-positions, the single chain having a formula selected from $-NR_5-(CO)_m-NH-$, $-CR_5=CH-CO-NH-$, $-O-CH_2-CO-NH-$, $-CO-CH=CR_5-NH-$, $-CO-NH-CO-NH-$, $-CONH-CR_6=N-$, $-CR_6=N-CO-NH-$, $-NR_5-(CO)_m-O-$ or $-NH-CR_5=N-$

where the symbols R_5 , R_6 and m are defined above and

when R_3 and R_4 are in the 1,2- position and R_7 is located in the 3- position or when R_3 and R_4 are in the 3,4- position and R_7 is located in the 2-position or when R_1 and R_2 are in the 8,9- position and R_7 is located in the 10-position or when R_1 and R_2 are in the 10, 11- position and R_7 is in the 9- position then R_7 is hydrogen or C_{1-2} alkoxy, otherwise R_7 is hydrogen, with the proviso that if R_1 and R_2 are hydrogen then R_3 and R_4 cannot be hydrogen.

Preferably in R_5 and R_6 , any C_{1-4} alkyl is ethyl or methyl.

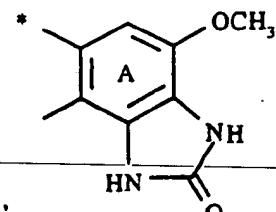
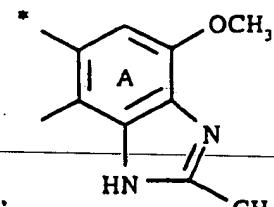
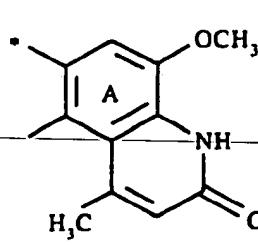
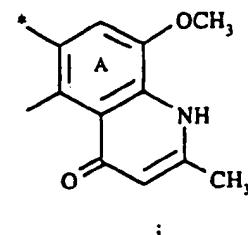
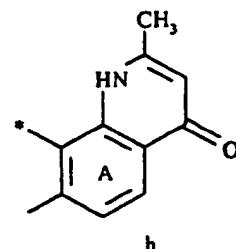
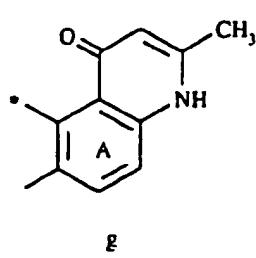
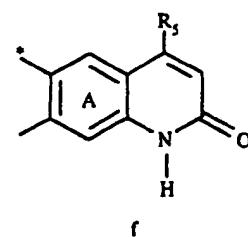
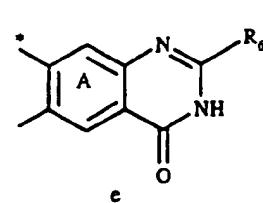
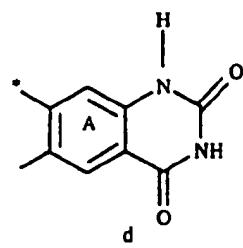
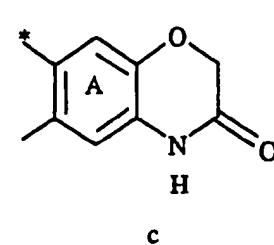
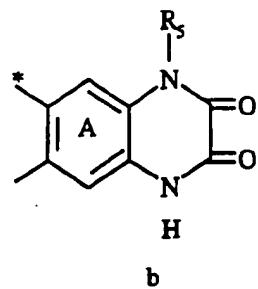
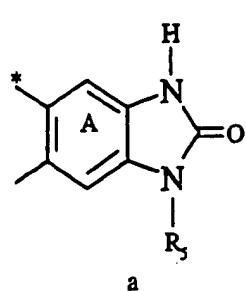
Compounds of formula I can be prepared by condensing 1 mole of 2,3,5,6-tetrachloro-1,4-benzoquinone with 2 moles of a compound of formula II

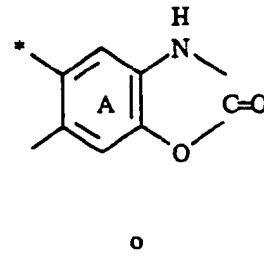
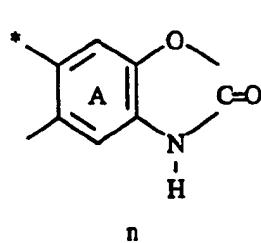
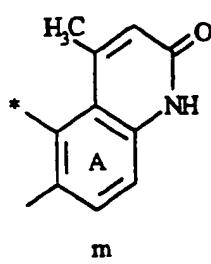


in which R_8 and R_9 have the meaning of R_1 and R_2 or of R_3 and R_4 respectively. If rings A and B in compounds of formula I are substituted differently, appropriate measures for asymmetric condensation have to be taken.

Compounds of formula II are known, for example as is described in D.O.S 2855883 or can be made from known compounds by known methods. 2,3,5,6-tetrachloro-1,4-benzoquinone is also known.

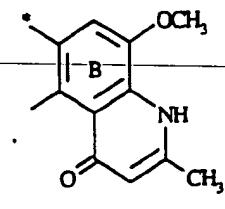
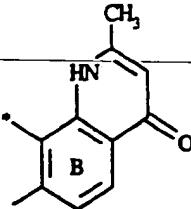
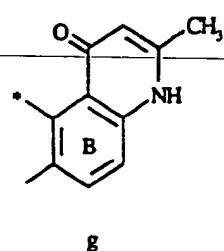
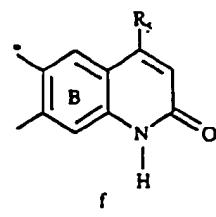
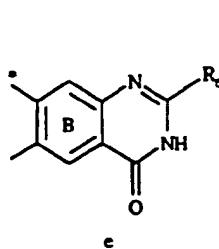
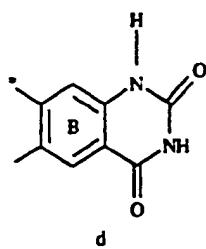
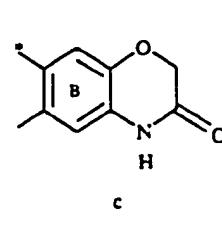
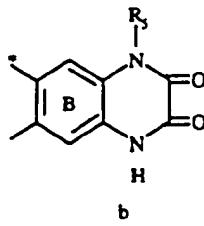
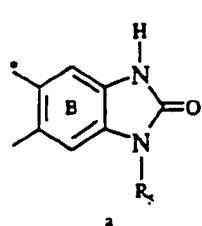
Preferably in the compounds of formula I, the ring A together with R_1 and R_2 forms a group of formula a) to o) below

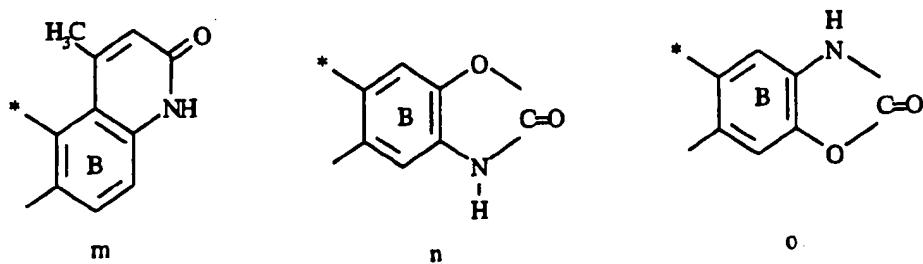
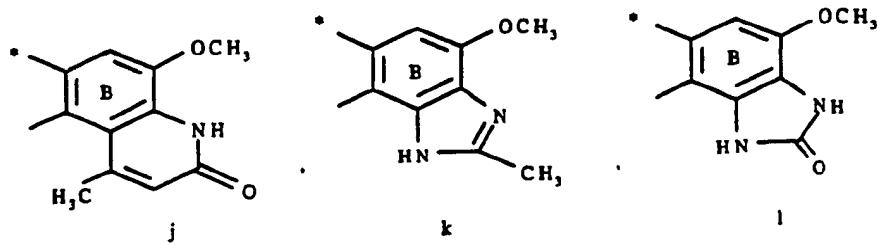




where the starred atom is attached to the nitrogen of ring C.

Preferably, in the compounds of formula I, the ring B together with R₃ and R₄ forms a group of formula a) to m) below





where the starred atom is attached to the N atom of ring D.

Preferably R_5 is R_5' where R_5' is hydrogen, methyl and ethyl.

Preferably R_6 is R_6' when R_6' is hydrogen, methyl or ethyl.

Most preferred compounds of formula I are the ones in which ring A together with R_1 and R_2 , as well as ring B together with R_3 and R_4 form a group of formula a) or j).

The compounds of formula I are particularly useful as pigments for colouring plastics masses, including both solvent-free and solvent-containing masses of plastics or plastics resins. These include oil-based or aqueous paint systems and lacquers of various kinds. The compounds of formula I are also suitable for spin-colouring of viscose or cellulose acetate, for pigmenting of polyethylene, polystyrene, polyvinylchloride, rubber or artificial leather. They can also be used for printing inks in the graphic industry for

colouring paper masses, for coating of textiles or for any other pigment printing process.

The resulting pigmentations have excellent fastness to heat, light and weathering and chemicals. The pigments retain good strength of colour and have good application properties, for example flocculation fastness, fastness to crystallisation and good dispersing properties. In particular, they have good fastness to migration, blooming, overcoating and solvents. An aftertreatment of the untreated pigment in organic solvent at elevated temperature, for example at 110-200°C can improve the pigment properties. Such organic solvents (in which the pigment itself is not dissolved) include chlorobenzene, nitrobenzene, dimethylformamide, dimethylacetamide, glacial acetic acid, ethylene glycol and quinoline. Preferably such aftertreatment is combined with a milling or kneading operation.

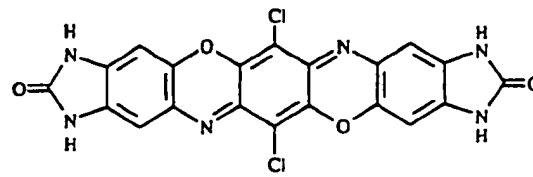
In the following Examples all parts and percentages are by weight and all temperatures are in °C. One part by volume is equivalent to the volume of one part by weight of water.

Example 1

22 parts of 6-methoxy-5-aminobenzimidazolone (-2), 15 parts of chloroanil (2,3,5,6-tetrachlorobenzoquinone) and 10 parts of water-free sodium acetate are added to 250 parts by volume of ethanol. This mixture is heated to boiling whilst stirring well, the mixture is allowed to cool, the resulting intermediate that crystallises out is filtered, and it is then washed with water and dried.

26 parts of this intermediate are added to 150 parts by volume of H_2SO_4 conc. at a temperature below 10° and stirred at room temperature for 12 hours. This is then poured onto ice, the resulting pigment is filtered and then this is washed acid-free with water and is then dried at 60°C under vacuum. Alternatively, the condensation product is diluted to 80% and the precipitated pigment filtered, washed with 300 parts of 80% H_2SO_4 , followed by 150 parts of 50% H_2SO_4 and then washed acid free with 2000 parts of water. The humid presscake is suspended in 250 parts of dimethylacetamid and the remaining water distilled off between 100-150°. After cooling to 120° the pigment is filtered, washed with 200 parts of cold dimethylacetamid, followed by 100 parts of isopropanol and then dried at 60° under vacuum.

The resulting pigment is of formula Ia



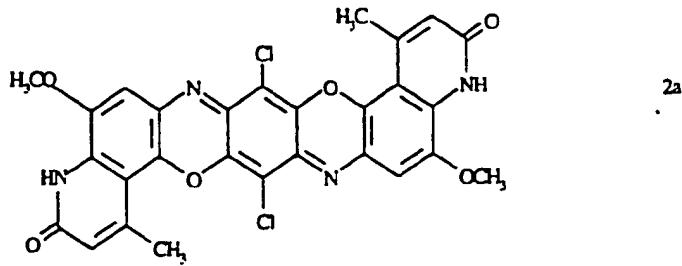
which colours plastics material such as PVC a violet tone with excellent migration and solvent fastness properties.

Aftertreatment: 20 parts of this pigment are put into a heated (70-78°) kneader, 23 parts ethylene glycol and 160 parts NaCl are added and this mixture kneaded at 0.6 bar

for two hours. Thereafter the mixture is suspended in 1500 parts water and heated at 80° for two hours. The hot mixture is filtered and the pigment obtained thereby is washed with 4000 parts hot water and dried in vacuo at 80°.

Example 2

24 parts of 4-methyl-5,8-dimethoxy-6-amino-quinolone(-2), 12 parts of chloroanil and 8.5 parts of water-free sodium acetate in 300 parts by volume of ethanol are boiled for 6 hours whilst stirring well under reflux. The mixture is then brought down to room temperature and the resulting precipitate is washed with ethanol, water and again with ethanol. The ethanol-damp intermediate product is suspended in 300 parts of o-dichlorobenzene and forms a fine suspension. This is boiled for 8 hours while stirring well. The ethanol-dichlorobenzene mixture is then distilled off. The mixture is allowed to cool to 100°C, the product is filtered, the residue is then washed, first with hot o-dichlorobenzene, then with hot ethanol then with hot water and finally with cold water. The product is then dried. The resulting pigment is of the formula 2a

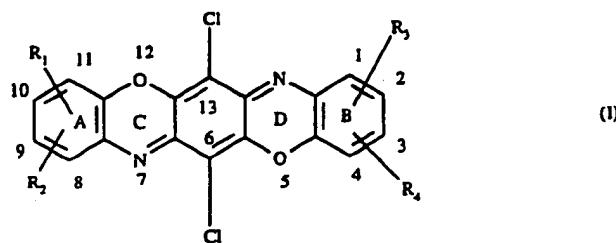


which colours plastics material such as PVC a blue tone with good migration and solvent fastness properties.

Aftertreatment: 10 parts of this pigment are put into a ball mill with capacity of 0.5 liter together with 30 parts NaCl, 150 parts acetone and 1000 parts steel balls of 4 mm diameter and milled for 72 hours. The mixture is then sieved for separation from the balls, filtered and washed with 2000 parts water! The pigment is finally dried in vacuo at 80°.

Examples 3-15

Analogously to Example 1, a compound of formula I

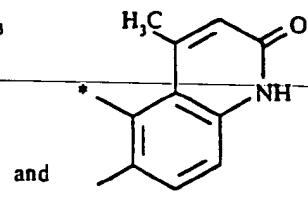
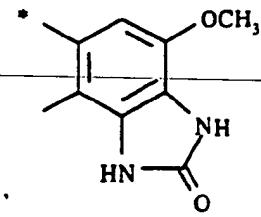
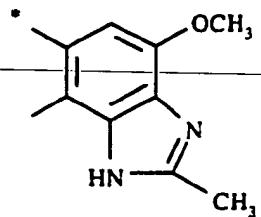
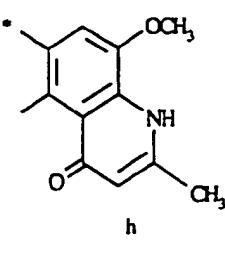
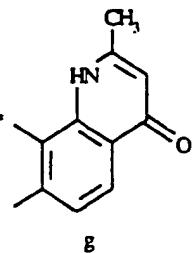
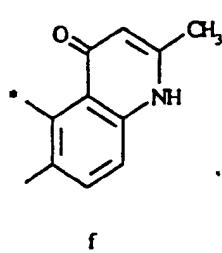
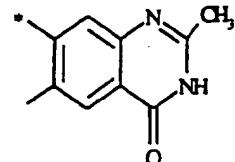
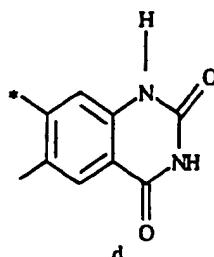
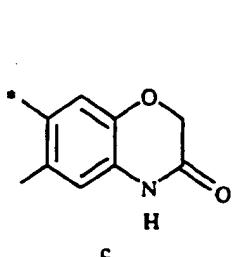
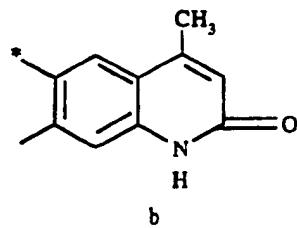
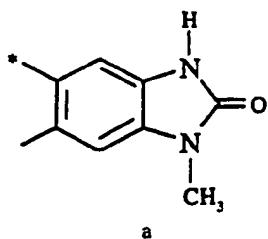


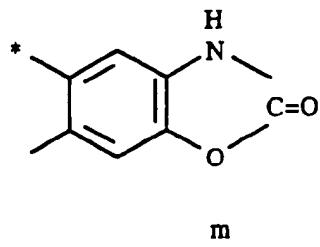
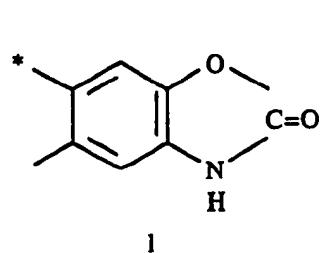
in which ring A together with groups R_1 and R_2 and ring B together with R_3 and R_4 are as in the Table below, can be prepared from appropriate reactants.

Table I

Ex.	ring A with R_1 and R_2	ring B with R_3 and R_4
3	a	a
4	b	b
5	c	c
6	d	d
7	e	e
8	f	f
9	g	g
10	h	h
11	i	i
12	j	j
13	k	k
14	l	l
15	m	m

The groups a-m are as follows:





where the carbocyclic rings are ring A or B respectively and the starred atoms attach to the N atom in ring C or D respectively.

Application Example A

A composition comprising:-

4 parts of the pigment of Example 1 and

96 parts of a mixture of

50 parts of 60% solution of coco-aldehyde melamine resin solution in butanol

10 parts of xylene and

10 parts of ethyleneglycolmonoethylether

are milled for 24 hours in a ball mill. The resulting dispersion is sprayed on an aluminium sheet, allowed to air-dry for 30 minutes and is then stoved for 30 minutes at 120°C. A brilliant reddish-violet coated plate with very good migration fastness having good light and weather fastness results.

Application Example B

The preparation of a 0.1% coloured PVC sheet (ratio of coloured pigment to white pigment 1:5) is performed as follows:-

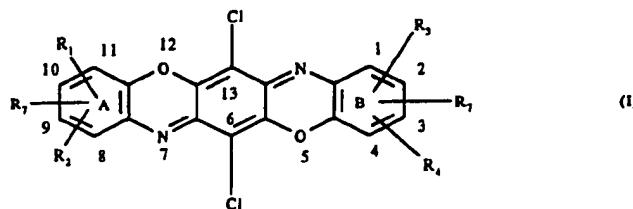
16.5 parts of a softener made of equal parts of dioctylphthalate and dibutylphthalate are mixed with 0.05 parts of a pigment of Example 1 and 0.25 parts of titanium dioxide. 33.5 parts of polyvinylchloride are then added. The mixture is then passed between two

rollers in a rolling mill to form a sheet (that is cut and re-rolled). One of the rollers is at a temperature of 40°C and the other is at 140°C. The mixture is then conventionally extruded as a sheet and is pressed between two polished sheets for 5 minutes at 160°C.

The resulting reddish-violet coloured PVC sheet has a high brilliancy and very good migration and light fastness. Application Examples A and B can be repeated using the same amount of any one of the pigments of Examples 2 to 15.

What is claimed is:

1. A compound of formula I,



in which R_1 and R_2 are either both hydrogen or R_1 and R_2 together form a single chain linking the 8,9-; 9,10- or 10, 11-positions, the single chain having a formula selected from $-NR_5-(CO)_m-NH-$, $-CR_5=CH-CO-NH-$, $-O-CH_2-CO-NH-$, $-CO-CH=CR_5-NH-$, $-CO-NH-CO-NH-$, $-CO-NH-CR_6=N-$, $-CR_6=N-CO-NH-$, $-NR_5-(CO)_m-O$ or $-NH-CR_5=N-$

where

R_5 is hydrogen, C_{1-4} alkyl or phenyl, R_6 is hydrogen, C_{1-4} alkyl or phenyl;

m is 1 or 2 and

R_3 and R_4 are either both hydrogen, or R_3 and R_4 together form a single chain linking the 1,2-, 2,3- or 3,4-positions, the single chain having a formula selected from

$-NR_5-(CO)_m-NH-$, $-CR_5=CH-CO-NH-$, $-O-CH_2-CO-NH-$, $-CO-CH=CR_5-NH-$,

$-CO-NH-CO-NH-$, $-CONH-CR_6=N-$, $-CR_6=N-CO-NH-$, $-NR_5-(CO)_m-O$ or $-NH-CR_5=N-$

where the symbols R_5 , R_6 and m are defined above and

when R_3 and R_4 are in the 1,2- position and R_7 is located in the 3- position or

when R_3 and R_4 are in the 3,4- position and R_7 is located in the 2-position or

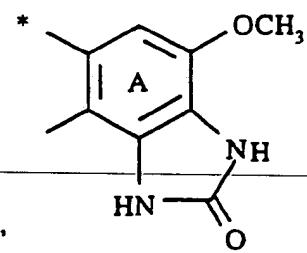
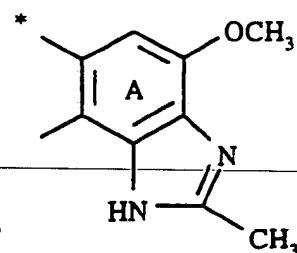
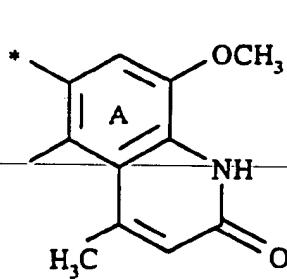
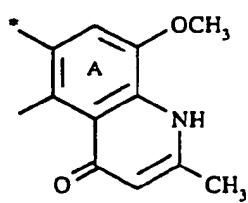
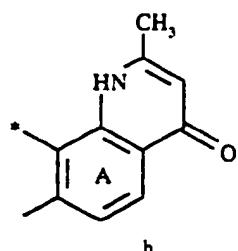
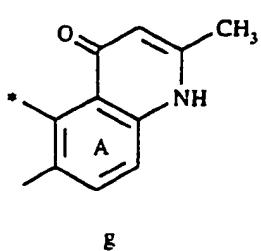
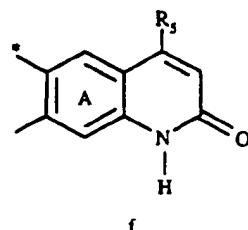
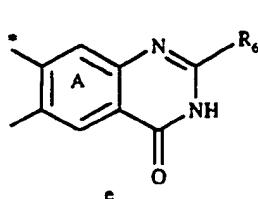
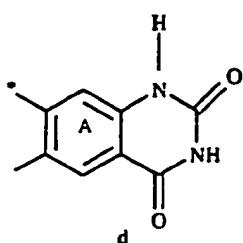
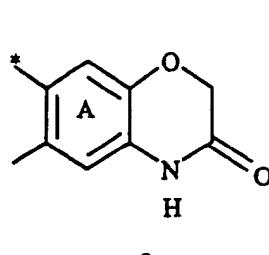
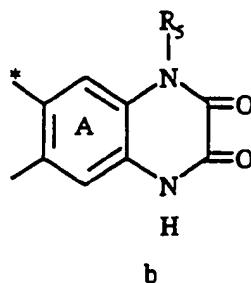
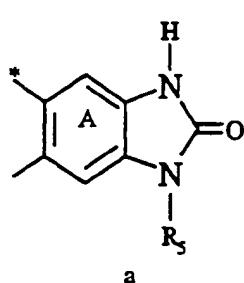
when R_1 and R_2 are in the 8,9- position and R_7 is located in the 10-position or

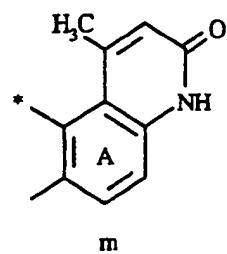
when R_1 and R_2 are in the 10, 11- position and R_7 is in the 9- position

then R_7 is hydrogen or C_{1-2} alkoxy, otherwise R_7 is hydrogen,

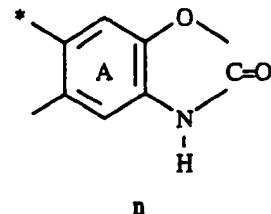
with the proviso that if R_1 and R_2 are hydrogen then R_3 and R_4 cannot be hydrogen.

2. A compound according to Claim 1 in which, in the compounds of formula I, ring A together with R₁ and R₂ forms a group of formula a) to o) below,

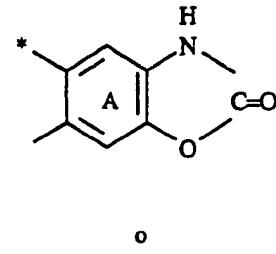




m



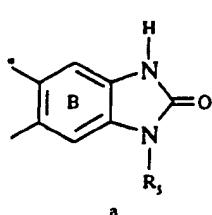
n



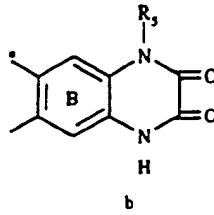
o

in which R_5 and R_6 are as defined in Claim 1, and where the starred atom is attached to the N atom of ring C.

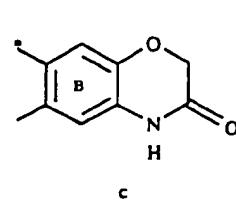
3. A compound according to claim 1 in which the ring B together with R_3 and R_4 forms a group of formula a) to o) below



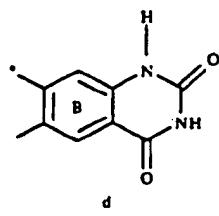
a



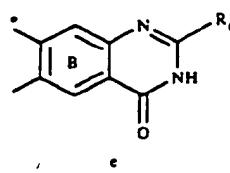
b



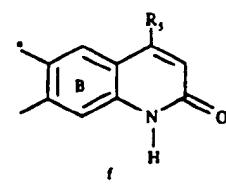
c



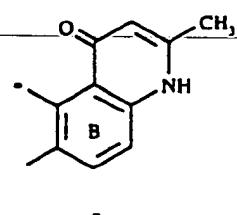
d



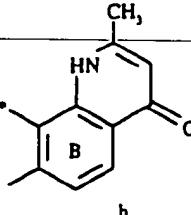
e



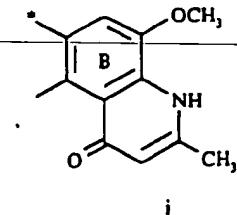
f



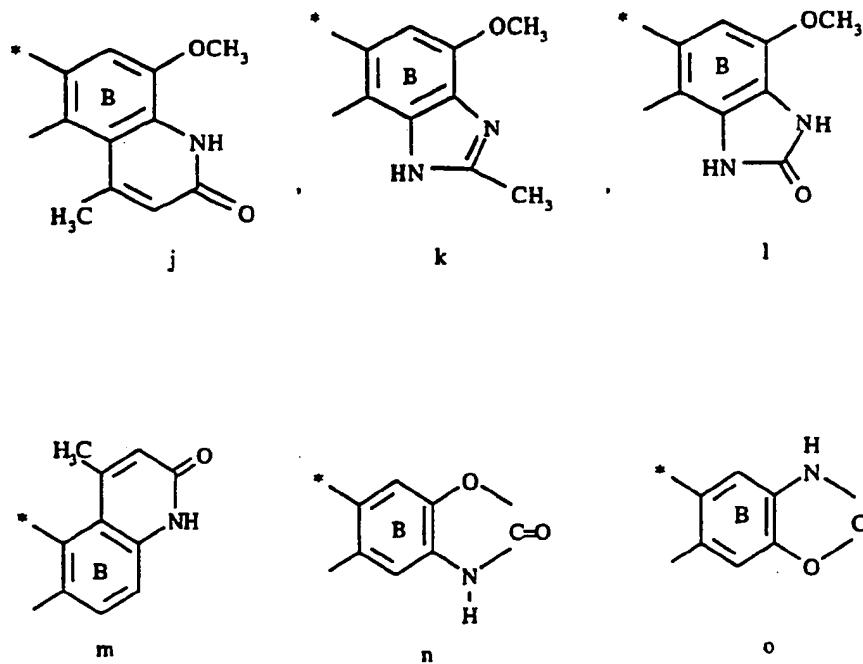
g



h



i

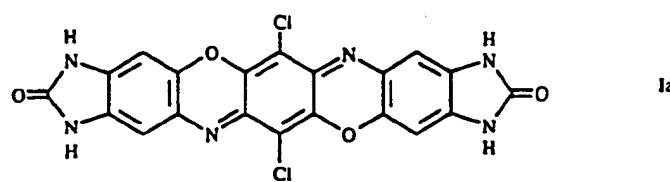


where R₅ and R₆ are as defined in Claim 1 and where the starred atom is attached to the N atom of ring D.

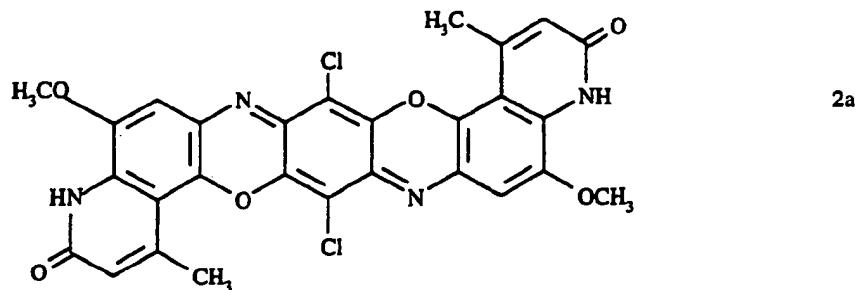
4. A compound according to Claim 1 in which R₅ is R₅' where R₅' is hydrogen, methyl and ethyl.

5. A compound according to Claim 1 in which R₆ is R₆' when R₆' is hydrogen, methyl or ethyl.

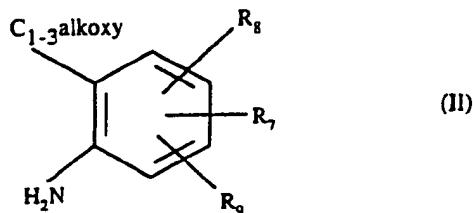
6. A compound of formula Ia



7. A compound of formula 2a



8. A process for preparing a compound of formula I as defined in claim 1 by condensing 1 mole of 2,3,5,6-tetrachloro-1,4-benzoquinone with 2 moles of a compound of formula II



in which R₈ and R₉ have the meaning of R₁ and R₂ or of R₃ and R₄ respectively.

9. Use of a compound of formula I as defined in claim 1 as a pigment for colouring plastics masses.

10. Plastics masses containing compounds of formula I as defined in claim 1.

10
Patents Act 1977

E: niner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9424384.7

Relevant Technical Fields

(i) UK Cl (Ed.N) C4P (PBA)
(ii) Int Cl (Ed.6) C09B

Search Examiner
A J RUDGE

Date of completion of Search
1 MARCH 1995

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-
1-10 (AS NOTED)

(ii) ONLINE DATABASES: CAS

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A	US 4395545	(ADAM) see columns 11-12	1 at least

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).